ARMORED MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY

Report On

PROJECT NO. T-12 - TEST OF EAR PROTECTIVE DEVICES - SILENTS

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Action copies have been forwarded to Office of the Surgeon General, Occupational Hygiene Branch for approval and execution.

Project No. T-12

15 October 1945

Serial

U.S. Armored medical research laboratory,
Fort Knox, Ky.

Project no. T-12

ARMORED MEDICAL RESEARCH LABORATORY
Fort Knox, Kentucky

SPMEA 741-2
Project No. T-12

15 October 1945

1. PROJECT: No. T-12, Test of Ear Protective Devices - Silents.

a. Authority: 1st Indorsement, ASF, SGO 17 July 1945, (SPMDO).

b. Purpose: To test and evaluate subject ear protective device compared to the device now standardized by ASF for procurement and issue.

2. DISCUSSION:

a. The requirement for acoustic protection for military personnel to prevent damage from gun fire and blast has been clearly shown in an earlier report. (AMRL, Project No. 26, dated 5 August 1944).

b. Various types of ear protective devices are available, some more suitable for military use than others. Consideration in the selection of a device must be given to blast protection, comfort, attenuation of spoken voice, cleanliness, and sizing.

c. A recommendation for adoption would necessarily require a competitive ear protective device to be superior in quality to the present standardized ear protective device, V51R (Ear Wardens).

d. The subject ear protective devices, Silents, were tested and comparisons were made with the NDRC, V51R (Ear Warden), using a group of 7 men as subjects.

3. CONCLUSIONS:

a. Blast protection and attenuation offered by subject device were slightly inferior to standardized V51R ear protector.

b. For periods of wear of one hour or longer the Silents were uncomfortable and irritating.

c. Universal size arrangement of subject plug is a desirable feature of the subject device.

d. The principle of closing the ear canal entrance rather than depending upon an insert into the canal is desirable, providing a satisfactory acoustic seal is maintained.

4. **RECOMMENDATIONS:**

a. That subject ear protective device, Silents, be considered less satisfactory than the ASF standardized issue ear protectors, V51R (Ear Warden).

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3 Incls.
Incl. #1 - Appendix
Incl. #2 - Figure 1
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APPENDIX

1. DISCUSSION:

The requirements of acoustic protection for military personnel exposed to blast and gun fire were presented in an earlier report (AMRL, Project 26, dated 5 August 1944). Subsequent to that date Army Service Forces standardized and procured for issue an ear protective device, V51R (Ear Warden), developed by the National Defense Research Council, which is equal or superior to available commercial type protective devices. Obviously any device proposed to replace the standardized plug must prove superior.

Consideration in the selection of a suitable ear protective device must be given to blast protection, comfort, attenuation, cleanliness, and sizing. To achieve maximum blast protection an adequate acoustic seal must be maintained which may be accomplished by inserting a plug into the outer ear canal, or covering the entrance to the canal. Of importance in maintaining the seal is a satisfactory design of the protective device to insure its remaining in proper position without frequent adjustment by the wearer. For a plug to be worn in preference to cotton or other less satisfactory acoustic material, it must be comfortable, and must not produce irritation or chafing. Attenuation, a measure of the ability to hear voice conversation with the device inserted, is important from the viewpoint of receiving commands. Sizing of plugs, of course, is a real consideration, one which will allow a maximum number of adequate fits for a maximum number of men with a minimum quantity of plugs. For this a universal adjustable fit is desirable. Present standardized protective device is issued in three sizes, designed to fit a maximum number of ears.

2. DESCRIPTION OF EAR PROTECTIVE DEVICE, SILENTS:

This device is a molded, synthetic rubber, two-piece ear plug. (See Figure 1). A conical shaped piece attached to a stem is inserted in the entrance of the ear canal. A second piece, shaped much like a wing nut is inserted below the anthelix to keep the plug in place. This section is adjustable to allow for varied ear sizes by sliding on the stem. Once adjusted the friction between the two rubber parts maintains this adjustment.

3. DESCRIPTION OF TEST:

Of a group of 25 men whose ears were medically examined, 15 were selected who had no apparent disability. Of these 15, seven, ages 19 to 27 years, who had the best hearing, based on repeated audiograms performance, using a Maico Audiometer in a quiet room, were selected for test.

In order to make a comparison with the V51R protector, tested several months previously, the same test procedure was followed with the Silents. Each subject with the device in one ear was exposed to the blast from three consecutive rounds of 75 mm cannon, his test ear normal to the muzzle at a distance of six feet. Immediately following this exposure an audiogram was again made. The audiogram difference in values for each frequency represented the loss suffered

due to the blast exposure. The other ear tightly covered by the subject's hand and away from exposure, was also checked by an audiogram to serve as an unexposed control.

The average loss for each of 10 given pure tone frequencies was then determined for the 7 subjects and the values plotted on a curve. For comparison with the V51R protective devices tested earlier, the values obtained at that time for twelve subjects were also plotted on this curve. (See Figure 2A).

To obtain information on the relative attenuation of the two devices, results of tests on these 7 subjects wearing the Silents were compared to those of the 12 subjects who earlier wore the V51R devices. (See Figure 2B).

At the end of the tests the men were questioned regarding comfort of wear and ability of the device to remain in place.

4. RESULTS OF TEST:

Hearing loss following blast exposure was slightly greater with the subject plug than with the V51R device. Maximum loss difference was 2Db. which is within an allowable error as affected by exterior noise level. (See Figure 2A).

Attenuation tests, illustrated in Figure 2B, for the two devices show the V51R to be superior to Silents for the center speech range as well as for the ten pure tones from 128 to 11584 C.P.S.

Five of the 7 subjects complained that the Silents were uncomfortable to wear after one hour, the remaining two experienced no discomfort. These 5 men stated that they would prefer wearing cotton or waste in spite of the reduced insulation offered. None of the subjects experienced pain or shock from the blast exposure.

5. CONCLUSIONS:

The Silents ear protective device offers considerable advantages over many commercial ear protectors, but fails to show an advantage over the ASF standardized ear protector, V51R (Ear Warden). The universal size arrangement of this device is a desirable feature as is the principle of an acoustic seal covering the entrance of the ear canal. The discomfort and irritation experienced by wearers is a disadvantage, probably due to the stiffness of the rubber material.

"Silent" Ear Protector

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Figure 1

Incl. #2

FIG. 2A

TEMPORARY LOSS ABOVE NORMAL
FOLLOWING STANDARDIZED EXPOSURE

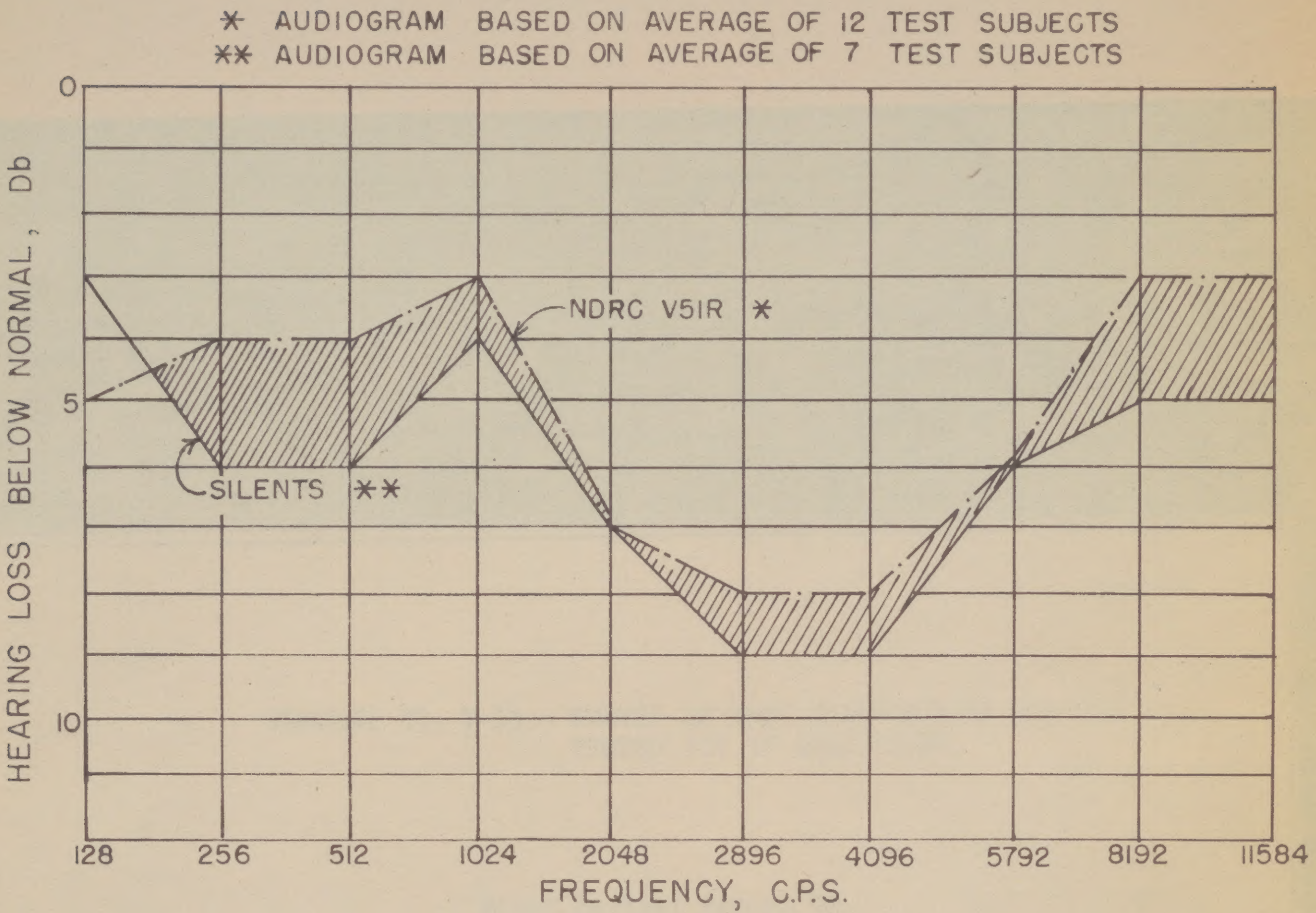
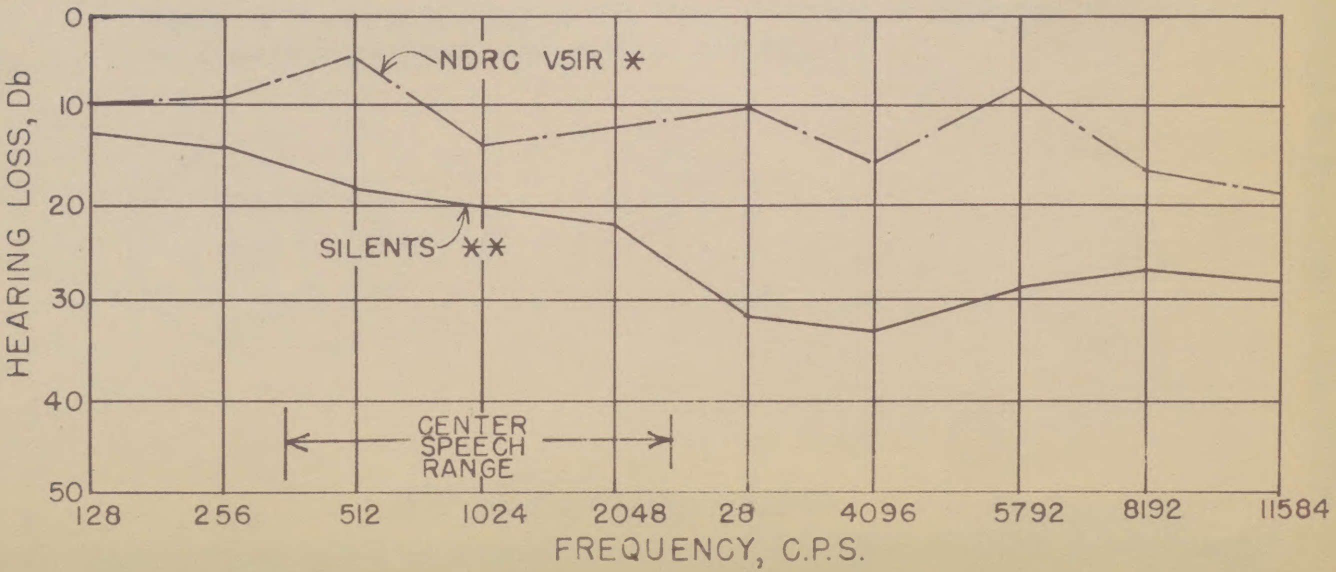


FIG. 2B
AVERAGE ATTENUATION OF TEST EAR DEVICES



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